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Trial of labor after cesarean:
attempted operative vaginal delivery
versus emergency repeat cesarean, a
prospective national cohort study.

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ABSTRACT

Objective

To compare neonatal and maternal outcomes of attempted operative vaginal delivery with emergency repeat cesarean in trial of labor after cesarean.

Study design

Prospective 8-year cohort analysis using the Netherlands Perinatal Registry, including women with one prior cesarean giving birth through operative vaginal delivery or emergency repeat cesarean (n = 12860). A multivariate analysis was performed. Odds ratios (OR) and adjusted odds ratios (aOR) were calculated.

Results

Attempted operative vaginal delivery increases the risk on neonatal birth trauma (aOR 15.0 (5.94 to 38.0)) and postpartum hemorrhage (aOR 2.59 (2.17 to 3.09)), and lowers the risk of wet lung syndrome (aOR 0.53 (0.35 to 0.80)) and neonatal convulsions (aOR 0.47 (0.24 to 0.91)).

Conclusion

We found a highly increased risk of neonatal birth trauma and a moderately increased risk of postpartum hemorrhage but slightly lower risks of wet lung syndrome and neonatal convulsions after attempted operative vaginal delivery compared with emergency repeat cesarean.

INTRODUCTION

When a woman is attempting vaginal birth after a cesarean (VBAC) and the second stage of labor is not progressing, there are two options. Obstetricians can decide, together with the woman and her partner, to perform an emergency cesarean or, if feasible, to perform a vacuum or forceps extraction and thus trying to achieve vaginal birth. However, there is a lack of evidence concerning the outcomes of repeat cesarean versus operative vaginal delivery during attempted VBAC. Data on outcomes could help obstetricians inform women in advance about the outcomes of different modes of delivery; that is, successful VBAC, cesarean in first or second stage or operative vaginal delivery. We addressed the following research questions: is a history of cesarean a contraindication for operative vaginal delivery? What are the neonatal and maternal outcomes of attempting operative vaginal delivery compared with emergency repeat cesarean in these women? This study is a first attempt to compare the intervention of operative vaginal delivery with emergency repeat cesarean to obtain a general impression on the neonatal and maternal outcomes in these two modes of delivery after cesarean.

MATERIALS AND METHODS

We studied women who delivered for the second time between 1 January 2000 and 31 December 2007 in the Netherlands after one previous cesarean. The data were extracted from the Netherlands Perinatal Registry. This registry contains information on pregnancies, deliveries and neonatal (re)admissions until 28 days after birth. The database consists of three different registries: the midwifery registry, the obstetrics registry and the neonatology registry. These registries are linked by a validated linkage procedure.^{1,2} All data in the Netherlands Perinatal Registry are voluntarily registered by the caregiver during prenatal care, delivery and the neonatal period. The data are sent annually to a national registry office, where a number of consistency checks are carried out. The Netherlands Perinatal Registry covers approximately 95% of all deliveries in the Netherlands.³ As the records included in the registry are entered at child level, there is no unique maternal identifier available to follow-up on outcomes of subsequent pregnancies of the same mother. To create a maternal identifier, a longitudinal probabilistic linkage procedure in which records of children of the same mother were linked was performed, which at the moment of our analyses was completed up until 31 December 2007. A more detailed description of this procedure can be read in the article of Schaaf et al.⁴

Inclusion and exclusion criteria

We included women with a history of cesarean who delivered by emergency repeat cesarean or by operative vaginal delivery in their second pregnancy. Definition of emergency cesarean was a cesarean which was not elective or planned and which could be on maternal or fetal indication. Definition of operative vaginal delivery was delivery by vacuum or forceps extraction. Because the Netherlands Perinatal Registry does not contain data on timing of intervention, women in the first and second stage of labor were included in the emergency cesarean group. Also, the Registry did not allow differentiation between operative vaginal delivery by vacuum or forceps extraction. We excluded women with a gestational age less than 37 or more than 42 weeks at the start of delivery in their current pregnancy, a multifetal pregnancy, a non-cephalic (breech, transverse) presentation or women with antepartum fetal demise.

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Study groups

We compared women who delivered by emergency repeat cesarean in first or second stage of delivery with women in whose case operative vaginal delivery was attempted. Women who delivered by emergency repeat cesarean after a failed attempted operative vaginal delivery were placed in the attempted operative vaginal delivery group. We did so to get results on the intention of the mode of delivery. As an additional analysis, we compared adverse outcomes in women who delivered by successful operative vaginal delivery with women who delivered by emergency cesarean after failed operative vaginal delivery.

Outcomes

Our main outcomes were neonatal and maternal complications of either attempted operative vaginal delivery or emergency repeat cesarean. Neonatal complications consisted of either a 5-min Apgar score less than 7, wet lung syndrome, birth trauma, convulsions, meconium aspiration, death during labor and death within 28 days. Birth trauma was a compound variable defined as brachial plexus injury, clavicular fracture, humeral fracture, cephalic hematoma, intracerebral bleeding, facial nerve palsy or femoral fracture. Maternal complications consisted of either postpartum hemorrhage, need for blood transfusion, uterine rupture or mortality. Postpartum hemorrhage was defined as blood loss of more than 1000 ml. Maternal mortality was within 42 days after birth from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.

Statistical analysis

Results were analyzed using Statistical Analysis Software 9.2 (SAS Institute Inc., Cary, NC, USA). To compare baseline characteristics (Table 1), we calculated statistical significance for differences in discrete measures using the chi-square test and for continuous measures using the t-test and Wilcoxon two-sample test. To compare outcomes, odds ratios (ORs) and their 95% confidence intervals (95% CI) were computed. We calculated adjusted ORs (aORs) using multivariate logistic regressions to correct for confounding of nonreassuring fetal status, the mode of first cesarean (planned), induction of labor, macrosomia, short interdelivery interval, ethnicity and socio-economic status. A P-value below 0.05 was considered to be statistically significant.

RESULTS

Figure 1 shows the flow diagram of data extraction of our study population from the Netherlands Perinatal Registry. Our cohort (n = 12 860) consisted of 5246 women in the attempted operative vaginal delivery group and 7614 women in the emergency repeat cesarean group. Operative vaginal delivery was successful in 95.8% (n = 5027). Of all attempted operative vaginal deliveries, 4.2% (n = 219) were unsuccessful and resulted in an emergency cesarean. These cases were included in the attempted operative vaginal delivery group and excluded from the emergency repeat cesarean group.

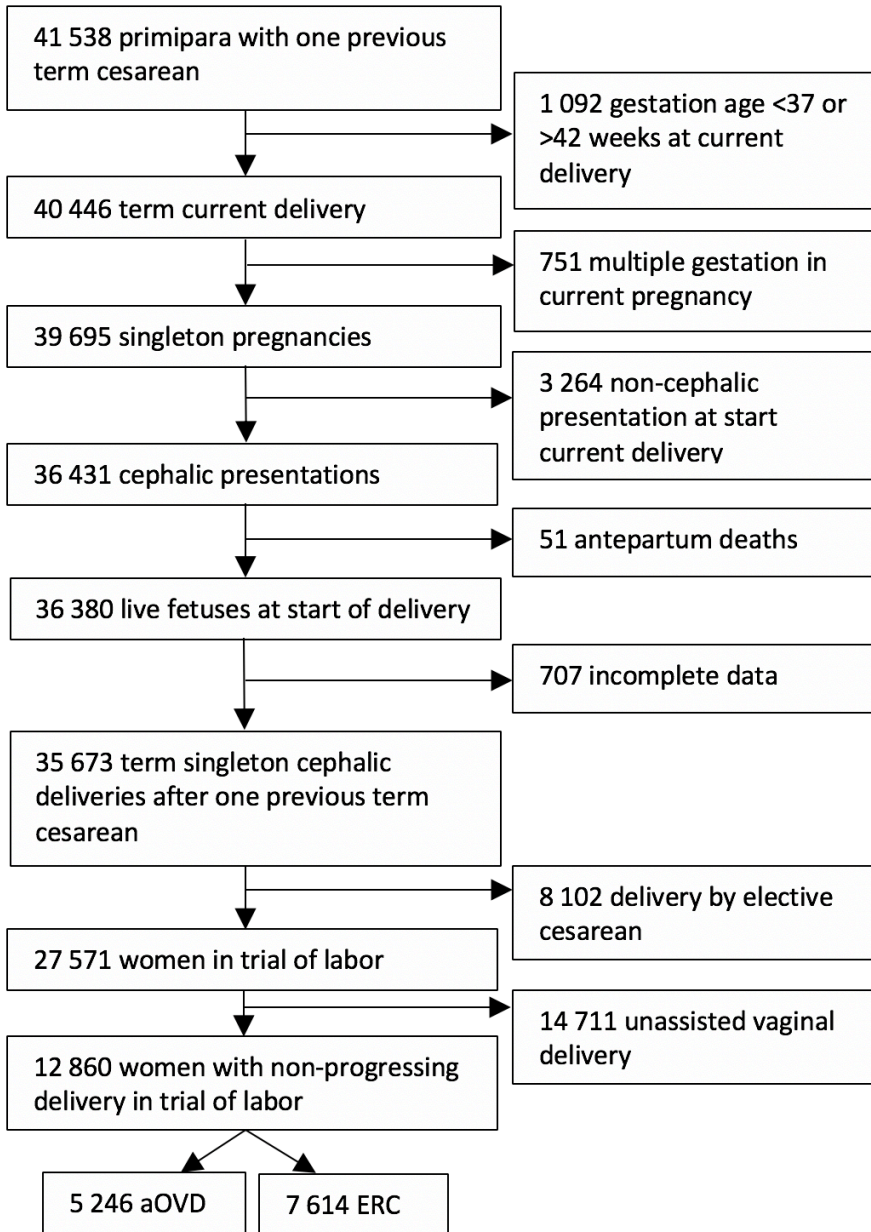


Figure 1. Flow diagram of data extraction
aOVD, attempted operative vaginal delivery; *ERC*, emergency repeat cesarean

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Table 1 summarizes baseline characteristics for the attempted operative vaginal delivery group and the emergency repeat cesarean group. Most characteristics differed significantly between the two groups. An interdelivery interval shorter than 1 year occurred more often in the emergency repeat cesarean group (0.47 versus 0.21%, P-value 0.02). Induction of labor was more common in women with attempted operative vaginal delivery (48.2 versus 46.1%, P-value 0.02). Macrosomia occurred almost two times more often in the emergency repeat cesarean group (7.50 versus 3.70%, P-value <0.0001). Table 2 shows neonatal and maternal outcomes of attempted operative vaginal delivery compared with emergency repeat cesarean. Concerning neonatal outcomes, the risk of birth trauma was higher in attempted operative vaginal delivery compared with emergency repeat cesarean (aOR 15.0, 95% CI 5.94 to 38.0). The risk of wet lung syndrome was lower after attempted operative vaginal delivery (aOR 0.53, 95% CI 0.35 to 0.80), as was the risk on neonatal convulsions (aOR 0.47, 95% CI 0.24 to 0.91). Concerning maternal outcomes, postpartum hemorrhage was more common in women with attempted operative vaginal delivery (aOR 2.59, 95% CI 2.17 to 3.09). Uterine rupture was reported less often in women with attempted operative vaginal delivery (aOR 0.06, 95% CI 0.02 to 0.21). Table 3 shows adverse outcomes in successful (n = 5 027) versus failed (n = 219) operative vaginal delivery. Uterine rupture seemed more common in the failed operative vaginal delivery group (OR 46.3, 95% CI 4.18 to 512.8), but numbers were too small to calculate an aOR.

Table 1. Baseline characteristics

		aOVD (n = 5 246)	ERC (n = 7 614)	p-value
Maternal characteristics	Mean maternal age (years)	32.2	32.0	0.02
	Ethnicity – Caucasian (n (%))	4 836 (92.2)	6 642 (87.2)	<0.0001
	Low socio-economic status (n (%))	935 (17.8)	1680 (22.1)	<0.0001
	First birth planned cesarean (n (%))	1 381 (26.3)	1 238 (16.3)	<0.0001
Delivery characteristics	Delivery interval <1 year (n (%))	11 (0.21)	36 (0.47)	0.02
	Median term (weeks)	40+2	40+3	0.07
	Induction of labor (n (%))	2 527 (48.2)	3 513 (46.1)	0.02
	Macrosomia (>4500g) (n (%))	194 (3.70)	571 (7.50)	<0.0001
	Nonreassuring fetal status(n (%))	2 665 (50.8)	2 879 (37.8)	<0.0001

aOVD, attempted operative vaginal delivery; ERC, emergency repeat cesarean

Table 2. Neonatal and maternal outcomes

	aOVD n = 5 246 n (%)	ERC n = 7 614 n (%)	OR (95% CI)	aOR (95% CI) ^a
Neonatal outcomes				
5-minute Apgar <7	101 (1.93)	135 (1.77)	1.09 (0.84 – 1.41)	0.89 (0.68 – 1.16)
Wet lung syndrome	33 (0.63)	82 (1.08)	0.58 (0.39 – 0.87)	0.53 (0.35 – 0.80)
Birth trauma	50 (0.95)	5 (0.07)	14.6 (5.84 – 36.8)	15.0 (5.94 – 38.0)
Convulsions	13 (0.25)	28 (0.37)	0.67 (0.35 – 1.30)	0.47 (0.24 – 0.91)
Meconium aspiration	6 (0.11)	14 (0.18)	0.62 (0.24 – 1.62)	0.56 (0.21 – 1.47)
Death during labor	3 (0.06)	3 (0.04)	1.45 (0.29 – 7.20)	0.95 (0.19 – 4.77)
Death within 28 days	14 (0.27)	22 (0.29)	0.92 (0.47 – 1.81)	0.62 (0.31 – 1.22)
Maternal outcomes				
HPP	364 (6.94)	219 (2.88)	2.52 (2.12 – 3.00)	2.59 (2.17 – 3.09)
Blood transfusion	22 (0.42)	26 (0.34)	1.23 (0.70 – 2.18)	1.39 (0.77 – 2.50)
Uterine rupture	3* (0.06)	54 (0.71)	0.08 (0.03 – 0.26)	0.06 (0.02 – 0.21)
Maternal death	0 (0)	0 (0)	N/A	N/A

aOVD, attempted operative vaginal delivery; ERC, emergency repeat cesarean; HPP, hemorrhage postpartum, defined as >1000ml blood loss; OR, odds ratio; CI, confidence interval; aOR, adjusted odds ratio; N/A, not applicable.

^a Adjusted for nonreassuring fetal status, first birth planned cesarean, induction of labor, macrosomia, short delivery interval, ethnicity and socio-economic status.

*2 of 3 cases of uterine rupture in aOVD-group occurred in patients with a failed operative vaginal delivery who received an emergency cesarean.

Table 3. Adverse outcomes in successful and failed OVD

	Successful OVD n = 5 027 n (%)	Failed OVD n = 219 n (%)	OR (95% CI)	Adjusted OR (95% CI) ^a
Neonatal outcomes				
Wet lung syndrome	29 (0.58)	4 (1.83)	3.21 (1.12 – 9.20)	1.16 (0.58 – 2.32)
Birth trauma	47 (0.93)	3 (1.37)	1.47 (0.45 – 4.77)	0.74 (0.42 – 1.31)
Convulsions	11 (0.22)	2 (0.91)	4.20 (0.93 – 19.1)	3.34 (0.91 – 12.2)
Maternal outcomes				
HPP	355 (7.06)	9 (4.11)	0.56 (0.29 – 1.11)	0.82 (0.66 – 1.02)
Uterine rupture	1 (0.02)	2 (0.91)	46.3 (4.18 – 512.8)	N/A

OVD, operative vaginal delivery; HPP, hemorrhage postpartum, defined as >1000ml blood loss; OR, odds ratio; CI, confidence interval; N/A, not applicable.

^aAdjusted for nonreassuring fetal status, macrosomia, ethnicity.

DISCUSSION

The results of our study show a highly increased risk of neonatal birth trauma after attempted operative vaginal delivery compared with emergency cesarean, but slightly lower risks of wet lung syndrome and neonatal convulsions. We find similar rates of low Apgar-score, meconium aspiration, death during labor and death within 28 days after birth. When considering maternal outcomes, postpartum hemorrhage occurs more often after attempted operative vaginal delivery, whereas uterine rupture is more often seen in women delivering by cesarean. Rates of blood transfusions were similar. Maternal death did not occur. The adverse outcomes in the attempted operative vaginal delivery group were not more common when operative vaginal delivery failed than when it succeeded.

Baseline characteristics of our two study groups differed significantly. A non-Caucasian ethnicity and low socioeconomic status were more common in the emergency repeat cesarean group. This suggests that the decision-making process might also be influenced by factors other than the actual course of delivery. The exploration of these factors is beyond the scope of this article, but it would be interesting to evaluate this prospectively. To the best of our knowledge, only one study on operative vaginal delivery versus cesarean in women attempting VBAC has been published up until now, that is by Kessous et al.⁵ in 2012. The researchers conducted a retrospective study including 319 patients with a previous cesarean and non-progression of labor in current delivery, comparing effects of vacuum extraction with repeat cesarean. They found no significant differences in maternal complications such as perineal lacerations, uterine rupture and postpartum hemorrhage. Concerning neonatal outcomes, the researchers found a 1-min Apgar score below 7 to be more common in the cesarean group, but differences were not significant in 5-min Apgar scores. Kessous et al. concluded that vacuum extraction does not seem to be an unsafe procedure when managing second stage labor disorders in patients with a previous cesarean. The researchers did not report any data on neonatal birth trauma.

In our cohort the absolute chance of neonatal birth trauma after attempted operative vaginal delivery is approximately 1%, with a significant aOR of 15.0 in comparison to emergency repeat cesarean at any stage during labor. In contrast to Kessous et al.,⁵ we found higher rates of postpartum hemorrhage and uterine ruptures after attempted operative vaginal delivery. Possible explanations are that women with an operative vaginal delivery have more risk of trauma to the genital tract leading to more postpartum hemorrhage. Women receiving a cesarean have a lower chance of partially retained placenta causing hemorrhage, because the uterus can be inspected during cesarean. Explanation of the higher uterine rupture rate is the fact that during cesarean, uterine dehiscence could have been scored as uterine rupture leading to an overestimation of uterine ruptures. Another explanation is that an obstetrician performs a cesarean rather than an operative vaginal delivery when a uterine rupture is suspected. Studies on operative vaginal delivery versus cesarean in women with no history of cesarean are more numerous. In 2003, a cohort of 393 women in the United Kingdom was analyzed. They either underwent an operative vaginal delivery in theater (n = 184) or a cesarean (n = 102) at full dilatation (leaving out women with a cesarean after failed attempted operative vaginal delivery).⁶ Results showed that neonatal trauma (defined as bruising, scalp and facial lacerations, cephalic hematoma, cerebral hemorrhage and brachial plexus injury) was more common in women with operative vaginal delivery (OR 13.90, 95% CI 3.28 to 58.8). This is consistent with our findings and suggests that an operative vaginal delivery in women attempting VBAC should be considered as a difficult operative vaginal delivery. In 2010, a prospective analysis of Contag et al.⁷ of 5341 laboring nulliparous women showed that

operative delivery does not result in increased adverse neonatal outcomes. Outcomes reported in their study were Apgar score, pH, base excess, brachial plexus injury, seizures and stay on neonatal intensive care unit. Although this study was underpowered for detection of differences in brachial plexus injury or seizures, the authors conclude that the primary delivery method does not appear to affect the incidence of neonatal asphyxia in nulliparous women. In 2012, Walsh and colleagues⁸ conducted a cohort study of 64 555 term neonates reaching the second stage of labor. They used the same 'intention-to-deliver' method as was used in this study. A total of 10 933 neonates were born by attempted operative vaginal delivery and 509 by cesarean. The researchers compared rates of peripartum neonatal mortality and neonatal encephalopathy, and found no significant differences between the two groups. In contrast to Contag et al.⁷ and Walsh et al.,⁸ we found a slightly higher rate of convulsions in the emergency cesarean group, possibly indicating more neonatal encephalopathy after cesarean. VBAC-rates differ widely across the industrialized world, varying from 9% in the USA to 55% in the Netherlands in 2004.⁹ In our cohort, 77% of women with a history of cesarean underwent trial of labor. This high percentage as compared with other countries makes the Dutch cohort suitable to investigate a research question as ours. We believe one can generalize the results to other countries with comparable methods and techniques of performing a cesarean or operative vaginal delivery, as well as patient characteristics.

Strengths and limitations

The data were collected from a database with a confined set of items. We encountered three disadvantages. Firstly, we were not able to score all items we would ideally like to include in our analysis, such as umbilical artery pH and admission to neonatal intensive care unit. This is a significant weakness. Also, the skill level of the operator performing the cesarean or the operative vaginal delivery was not scored. We do not know whether the skill level may have determined the choice for one or the other procedure. On the other hand, given the relatively high number of vacuum extractions, we may assume that obstetricians have ample experience with both cesarean and vacuum deliveries. Secondly, as already mentioned above, overestimation as well as underestimation of events is plausible because of the possibility that items are not scored at all or have been scored wrongly. For example, blood transfusion occurring 3 days post-delivery can have been discarded leading to underestimation of blood transfusion rates. Thirdly, and most importantly, we were not able to divide our cesarean group in first-stage and second-stage labor disorders, as timing and reason of intervention were not mandatory items in the database. We can hypothesize that the inclusion of first-stage emergency cesarean has decreased the effects on maternal outcomes, because cesareans in the second stage of labor are more prone to maternal complications.^{10,11} The presence of first-stage cesareans in our analyses might have led to an increased association of birth trauma in attempted operative vaginal delivery. During a second-stage cesarean, the development of a caput can be more complicated because of advanced descent in the pelvis, leading to a higher risk of birth trauma; the same problem we encountered with dividing the operative vaginal delivery group into vacuum-assisted deliveries and forceps-assisted deliveries. Because we were not able to analyze them separately, we were not able to report on vacuum-specific adverse outcomes or forceps-specific adverse outcomes.

The strength of our study is the fact that we were able to investigate a large subgroup of women that is difficult to include in a randomized controlled trial. Besides the ethical challenges of counselling and including women for such a trial, powering will be an enormous task. Looking closely at available data, as we did in the current study, might be the only way to investigate

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research questions as ours. Our data report on the absolute risks per treatment option. Our results can be helpful for counselling women about the chances on adverse events when her VBAC results in a cesarean or an attempted operative vaginal delivery.

CONCLUSION

In the current European and American legislation, a delivering woman should give her permission for any obstetric intervention after being properly counselled by the caregiver. Counselling should include mentioning the risks for the mother and her newborn. The practical recommendation of our results implies that women should be counselled about the 1% risk of neonatal birth trauma and almost 7% risk of postpartum hemorrhage after attempted operative vaginal delivery. We realize that including these risks in counselling might increase the rate of repeat cesarean. We believe these risks should be placed into perspective by taking the decreased risks on wet lung syndrome and convulsions after attempted operative vaginal delivery into account. We suggest that attempting operative vaginal delivery in trial of labor after cesarean should be considered as a difficult operative vaginal delivery. To counsel women and their partners more accurately in their choice for a VBAC, more knowledge about the long-term effects of a previous cesarean on a subsequent pregnancy and attempt for (operative) vaginal delivery is needed.

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